



A.D. 1860, 31st *MAY*. N^o 1343.

S P E C I F I C A T I O N

OF

JAMES ALEXANDER MANNING.

TREATING SEWAGE, &c.

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A.D. 1860, 31st *MAY*. N° 1343.

Treating Sewage, &c.

LETTERS PATENT to James Alexander Manning, of the Inner Temple, in the County of Middlesex, Esquire, for the Invention of “**IMPROVEMENTS IN THE TREATMENT, APPLICATION, AND USE OF SEWERAGE MATTERS AND THE GENERAL WASTES OF TOWNS AND FACTORIES.**”

Sealed the 20th November 1860, and dated the 31st May 1860.

PROVISIONAL SPECIFICATION left by the said James Alexander Manning at the Office of the Commissioners of Patents, with his Petition, on the 31st May 1860.

I, JAMES ALEXANDER MANNING, of the Inner Temple, in the County of
5 Middlesex, Esquire, do hereby declare the nature of the said Invention for
“**IMPROVEMENTS IN THE TREATMENT, APPLICATION, AND USE OF SEWERAGE MATTERS
AND THE GENERAL WASTES OF TOWNS AND FACTORIES,**” to be as follows, that is
to say :—

This Invention relates to certain improvements in the treatment of sewerage
10 matters and the general wastes of towns, whether of animal or vegetable origin,
by which one general and effective system applicable to all towns may be
established, and a thoroughly concentrated manure will be obtained for the
permanent benefit of agriculture.

By these improvements great economy is obtained over the present mode of
15 treating sewerage matters under Letters Patent granted to me, and bearing
date August 7th, 1855, No. 1786 ; July 5th, 1856, No. 1579 ; and February
1st, 1858, No. 179 ; whilst from the greater efficacy of this manure and
diminished bulk, useless matters being rejected and all fertilizing substances

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retained, a corresponding economy ensues to agriculturists in its application to the soil, as well as in its carriage or transit.

In this Patent it is proposed to adhere to the use of the alum sludge or its chemical equivalents as ascertained by analysis, that is to say, amongst other matters, its preponderating constituents of sulphate of alumina, sulphuric acid, 5 and peroxide of iron, as the chief agents for the deodorisation of the sewerage and the deodorisation also as well as the precipitation of all matters held in suspension therein, and of the waste animal charcoal, which is now employed as a decolorizer of the supernatant water, as well as a fertilizing agent in the subsequent preparation of the manure, as set forth in the Patents herein-before 10 recited. But, instead of applying the before-named substances in the first tanks or receivers of the sewerage from the common sewers, all matters capable of subsidence or deposit by their own specific gravity are allowed to settle down for a certain time, say, one or two hours. The supernatant water is then to be drawn off or discharged into a tank or tanks at a lower level, to 15 which one-half of the quantity of alum sludge employed by me in my former process will be sufficient to cause the precipitation of the finer particles of matter still held in suspension in the water. By these means a saving of fifty per cent. will be effected in the employment of the alum sludge, as experience has proved that the less the sewerage is charged with animal and vegetable 20 organic matters, the smaller is the quantity of alum sludge necessary for their precipitation. With respect to the animal charcoal employed in this process, a considerable change is effected in the mode of using it. The charcoal is made from the hoofs and horns of animals, and is a waste or refuse substance arising from the manufacture of prussiate of potash. It contains some salts amongst 25 its other impurities, which are of no use in the decolorization or the precipitation of any colouring matters in the sewerage waters. The charcoal is therefore lixiviated and afterwards dried in a furnace or oven before applying it in conjunction with the alum sludge as deodorizers and precipitants of the matters held in suspension in the sewerage, and an additional clarifier of the super- 30 natant water. If found useful or profitable the water of the lixiviation may be evaporated for the purpose of obtaining whatever salts may be found therein for admixture or otherwise with the manufactured manure. This mode of treating the sewerage residuum is applicable to the wastes of towns of almost every description, that is to say, to the contents of cesspools and privies mixed 35 or unmixed with coals, cinders, ashes, and household wastes, stable dung, the wastes of flesh, fish, and vegetable markets, as well as those of slaughter-house, breweries, distilleries, tanneries, glue factories, cotton wastes, dust bins, and all wastes of vegetable and animal origin. It is proposed to treat these

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substances by means of destructive distillation, by which process all fibrous or organic matters are destroyed, the mineral or inorganic constituents being alone preserved for the formation of an ash manure. While the nitrogenous gases or other useful products are carried over into receivers to be subsequently
5 treated chemically, so as to preserve all that is of a useful and fertilizing character, particularly the ammonia, which when so treated will be restored to the diminished bulk or volume of ash manure derivable from the original wastes. The ash is deprived of all cinders or useless matters after the ammonia, which they may have absorbed in the cesspools or privies, is extracted by the process
10 in question, by means of sifting through fine wire sieves. By this process the whole of the inorganic substances indispensable to the organism and development of plants, will be obtained by the agriculturist without being encumbered with the organic matters which usually abound in such substances. The mineral constituents of the food of man and beast, and of all decomposing
15 matters which are the chief food of plants, are thus returned to the soil ; while the nitrogenous or ammoniacal gases, which in the course of decomposition of the animal and vegetable matters contained in the heaps of dirt which are collected in or near to our cities and towns, all of which will thus be totally destroyed to the great benefit of the public health and the purification of the atmosphere,
20 so that the ammonia of the wastes alone will probably be equal in its positive chemical action on the mineral constituents or ash products of the animal and vegetable wastes in question, to convert them, or a considerable per-centage thereof, into food for the organism or development of all plants, and a manure will thus be obtained, which, if there be any truth in the discoveries of
25 chemical science, will far surpass any that has ever been applied to the uses of agriculture.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said James Alexander Manning in the Great Seal Patent Office on the 29th November 1860.

30 **TO ALL TO WHOM THESE PRESENTS SHALL COME**, I, JAMES ALEXANDER MANNING, of the Inner Temple, in the County of Middlesex, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Thirty-first day of May, in the year of our
35 Lord One thousand eight hundred and sixty, in the twenty-third year of Her reign, did, for Herself, Her heirs and successors, give and grant

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unto me, the said James Alexander Manning, Her special license that I, the said James Alexander Manning, my executors, administrators, and assigns, or such others as I, the said James Alexander Manning, my executors, administrators, or assigns; should at any time agree with, and no others, from time to time and at all times thereafter during the term therein 5 expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for “IMPROVEMENTS IN THE TREATMENT, APPLICATION, AND USE OF SEWERAGE MATTERS AND GENERAL WASTES OF TOWNS AND FACTORIES,” upon the condition (amongst others) that I, the said James Alexander 10 Manning, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent. 15

NOW KNOW YE, that I, the said James Alexander Manning, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, that is to say:—

My said Invention relates to certain “improvements in the treatment of 20 sewerage matters and the general refuse or waste matter of towns, whether of animal or vegetable origin, together with refuse, coal ashes, and cinders when mixed therewith.” Under these improvements, there is one general and effective system of treatment for the wet or sludgy deposits of sewerage matters, and another system of treatment for the dry refuse or waste of towns, 25 including the sewerage deposits, after having gone through the desiccative process detailed in my former Patents. This system is applicable to all towns, and a thoroughly concentrated manure may be thereby secured for the permanent benefit of agriculture.

By these improvements great economy is obtained over the modes of 30 treating sewerage matters described in the Specifications of Letters Patent granted to me, and bearing date the Seventh day of August, One thousand eight hundred and fifty-five, the Fifth day of July, One thousand eight hundred and fifty-six, and the First day of February, One thousand eight hundred and fifty-eight; whilst from the greater efficacy of the manure, and 35 its diminished bulk, a corresponding advantage ensues to agriculturists in its application to the soil, as well as great economy in its transit.

In the present Invention I use alum sludge, or its chemical equivalents, as ascertained by analysis, that is to say, amongst other matters, its principal

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constituents of sulphate of alumina, sulphuric acid, and peroxide of iron, the chief agents for the deodorisation of the sewerage waters and the precipitation, as well as the deodorisation of all the animal and vegetable organic matters held in suspension therein. I also use the silicate of alumina obtained from
5 the refuse of bog cannel coal, after the gas has been extracted therefrom, which may be used either by itself, or converted into some other form of alumina to assist in the process of precipitating the animal and vegetable organic matters held in suspension in sewerage waters. I also use, whenever it is desirable, waste animal charcoal, which is now occasionally employed by
10 me as a decolonizer of the supernatant water, as well as a fertilizing agent in the subsequent preparation of the manure, as set forth in the Specifications of my former Patents herein-before recited. But, instead of applying the before-named substances in the first tanks or receivers of the sewerage from the common sewers, all matters capable of subsidence or deposit by their own
15 specific gravity, such as road sand, street mud, and earthy matters in general, are allowed to settle down for a certain time, say, one or two hours. The supernatant water is then drawn off or discharged into a tank or tanks at a lower level, to which is added one-half of the quantity of alum sludge or its chemical equivalent, which is found sufficient to ensure the precipitation of the
20 finer and more valuable particles of matter still held in suspension in the water. Instead of drawing off the supernatant water into tanks at a lower level, I prefer in some cases to sink in the channel which conveys the sewerage waters from the common sewer to the tanks, a series of pits or cesspools, four or more feet deep, in which the road sand, street mud, and earthy
25 matters, or the greater part thereof are deposited of their own specific gravity. By these means a saving of fifty per cent. is effected in the employment of the alum sludge; for experience has proved that the less the sewerage is charged with earth matters, not only is the deposit obtained infinitely more valuable for the uses of agriculture, but the smaller is the quantity of alum sludge
30 necessary for the precipitation of the animal and vegetable organic matters held in suspension therein.

With respect to the animal charcoal employed in this process, when necessary or desirable, a considerable change is effected in the mode of using it. The charcoal is made from the hoofs and horns of animals, and is a waste
35 or refuse substance arising from the manufacture of prussiate of potash. It contains a considerable amount of alkaline salts amongst its other impurities, which are of no use in the decolourization or the precipitation of any colouring matters in the sewerage waters. The charcoal is therefore lixiviated, and afterwards dried in a furnace or oven, or by exposure to the atmospheric air

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before applying it in conjunction with the alum sludge, as deodorisers and precipitants of the matters held in suspension in the sewerage, and an additional clarifier of the supernatant water. If found useful or profitable, the water of lixiviation may be evaporated for the purpose of obtaining whatever salts may be dissolved therein for admixture or otherwise with the manufactured 5 manure.

The present Invention or process is applicable to the treatment of the wastes of towns of almost every kind, whether of animal or vegetable origin, that is to say, to the contents of cesspools and privies mixed or unmixed with coal, cinders, ashes, household wastes, stable manure, the refuse of flesh, fish, 10 and vegetable markets, as well as those of slaughter-houses, breweries, distilleries, tanneries, glue factories, cotton works, the refuse of dust binns, and all general similar matters of animal and vegetable origin, including also the sewerage deposits after being treated by the process herein-before mentioned.

In carrying these improvements into practical effect, I prefer the following 15 apparatus for effecting the destructive distillation of the refuse matters:—A series of three or other suitable number of cylindrical vessels or retorts are arranged in a stack or “bench” in the brickwork. The retorts are formed of iron, and they are disposed in the brickwork at an angle so as to admit of their contents being readily discharged from the lower ends. The lower 20 extremity of each retort extends over a vertical opening or recess in the brickwork, which affords access to the end of the retort, and this part of the retort is enclosed by a semicircular end plate, to which is hinged a flap door shutting in the other portion of the end of the retort. At the side of this recess in the brickwork, or at any other convenient part of the same, is arranged the 25 furnace for disiccating the matters placed in the retorts. The furnace flue is carried round the retorts so as to obtain the desired heating effect from the fuel, and a corresponding arrangement is common to all the retorts in the series. Branching away in a lateral direction from the upper part of the retort is a pipe for conveying away the gaseous products evolved from 30 the refuse matters on applying heat thereto. This pipe is carried outwards in a horizontal direction, and is then bent downwards so as to dip into a tank or reservoir containing water, which serves to absorb and condense the gaseous products. It is desirable to form this refrigerator as a closed vessel, so that when the water contained therein is saturated with the ammoniacal gaseous 35 products, the other gases pass through an elbow pipe fitted to the upper part of the refrigerator, and are conveyed into a second refrigerating vessel arranged in convenient proximity to the first. I prefer also to arrange the retorts so that their respective gas pipes or ducts may be readily carried into the refri-

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erator; to this end the retorts may be conveniently arranged in a radial direction, the several gas ducts converging to a central refrigerator or series of refrigerators. The upper end of each retort is fitted with a hopper to convey the refuse materials into the retort, and extending across the open
5 end of the retort is a sliding door or damper for preventing the escape of the gaseous matters. The sliding door is pushed to and fro by means of a laterally projecting handle, and the door, when pushed home in its receiving groove, may be luted if required to prevent the escape of the gaseous matters. The interior of each retort is fitted with an agitator so as to stir the mass of
10 materials in the retort, and bring the whole in contact with the heated surface. The agitator consists of a central longitudinal shaft supported in footstep and collar bearings in the retort, and furnished with radially projecting arms. Motion is given to the agitator by means of an ordinary winch handle fitted on the squared extremity of the shaft, as it is only necessary to
15 stir the materials from time to time. But where the manure works are of considerable magnitude, the agitators may be driven by steam power, the motion being imparted by spur gearing, which is put into and out of gear by means of a coupling as required; or the agitators may be actuated at intervals by self-acting mechanical means. Upon the refuse matters being placed in
20 the retorts, the fires are raised so as to bring the retorts up to a low red heat, or such a temperature as will destroy the organic matters as far as possible and requisite, but not sufficient to decompose the salts contained therein, or cause vitrification of the silicates. By means of the agitator, the mass is broken up, and the undried portions are brought into contact with the heated
25 surface; the gaseous products meanwhile pass off by the gas ducts to the refrigerators. The rotatory motion of the agitator in each retort serves also to assist in pulverising the mass, so that when the cinders are separated from the disiccated materials, all the products which are of value as manure are in a finely-divided state, and in the best and most effective form for application
30 to the land. The cinders and other similar matters are readily separated from the manure by means of a sieve arranged in a sloping position, and fitted below the lower extremity of each retort, so that when the contents of the retort are discharged, the desiccated manure falls through the sieve into the recess in the brickwork, and the cinders fall outside, and serve to supply the
35 furnaces for heating the retorts.

Faecal matters, when obtained without admixture, may be treated by distilling them to dryness in large cast-iron stills, the ammoniacal vapours being conveyed into refrigerators, as herein-before described. In some cases the ashes obtained after the destructive distillation of the refuse matters, as well

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as the waste matters of towns not previously subjected to distillation, may be placed in large wooden or other suitable covered receptacles for the purpose of subjecting them to the action of steam. This mode of treatment is for the purpose of dissolving out the alkaline or other soluble salts from the mass. The water of condensation or solution containing the soluble matters is subsequently evaporated or otherwise treated for the purpose of obtaining the valuable salts therefrom. The ammonia which is evolved from the materials in the retorts is absorbed by the water in the refrigerator, and this ammoniacal liquor is converted by the ordinary chemical process into sulphate of ammonia. If, however, it is found that the gaseous products evolved from the refuse materials in the retorts contain a sufficient amount of hydrogen and carbon, these gases may be judiciously applied to the illuminating of the manure works or other generally similar purposes. In boiling or distilling ammoniacal liquor in order to deprive it of its ammonia, it is usual to run off the liquor, after the first boiling, into a suitable vessel, and apply lime thereto and redistil it. I shorten this process by adding the cream of lime to the ammoniacal liquor in the boiling or distilling vessel, after the distillation has proceeded to a certain extent, the solution of lime being pumped into the boiler by means of a force pump. I thus obtain and draw over into the sulphuric acid tun all the ammoniacal products of the liquor at one instead of two operations. By these means the refuse matters of towns are utilized to the utmost extent, and are again made subservient to the purposes of agriculture and commerce.

Having now described and particularly ascertained the nature of my said Invention, and the manner in which the same is or may be used or carried into effect, I would observe, in conclusion, that what I consider to be novel and original, and therefore claim as the Invention secured to me by the herein-before in part recited Letters Patent, is,—

First, the system or mode of treating sewerage, fæcal matters, and the general refuse or waste matters of towns, factories, mills, and other generally similar places, for the purpose of obtaining manure and other useful products therefrom, as herein-before described.

Second, the general arrangement and construction of the machinery or apparatus for treating refuse or waste matters, and obtaining manure and other useful products therefrom, as herein-before described, or any mere modification of the same.

Third, the system or mode of treating sewerage by running it or allowing it to flow into a series of tanks or reservoirs, in order that it may deposit the sand, mud, and earthy matters, the supernatant fluid being subsequently run

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into other tanks or receptacles, where it is treated with alum sludge, or other suitable precipitant for the purpose of throwing down the fine particles of matter held in suspension, as herein-before described.

Fourth, the application and use of the silicate of alumina obtained from
5 the refuse of bog cannel coal to assist in the precipitation of the matters held in suspension in sewerage and other generally similar matters, as herein-before described.

Fifth, the application and use of the combustible gases obtained from refuse matters to the purposes of illumination and heating, as herein-before
10 described.

Sixth, the system or mode of utilising the gaseous products arising from the treating of refuse matters in retorts, so as to obtain from the ammoniacal liquor so produced the sulphate or other salts of ammonia; also the mode of applying the solution or cream of lime to the partially distilled liquor in the
15 boiler or distilling vessel, as herein-before described.

In witness whereof, I, the said James Alexander Manning, have here-
unto set my hand and seal, this Twenty-eighth day of November,
One thousand eight hundred and sixty.

JAMES ALEX. MANNING. (L.S.)

LONDON:

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Printers to the Queen's most Excellent Majesty. 1860.

